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50 T .100 2 X 10

I Video Amplifier Band Pass requirements

1. Requirement of pulse width 50 microseconds to 0.5 microsec.

(a) Upper Freq limit: $\frac{1}{2T}$

$= \frac{10^6}{2 \times .5} = 1$ mcs

(b) Lower Freq. limit:

Assume 10% droop. then

$\text{freq} = \frac{\%}{T}$

$\frac{\times 1.}{5.0 \times 10^{-6}} = 2000$ CPS.

2. Band pass required:

2000 to 1 mc/s.

This document is part of an integrated file. If separated from the file it must be subjected to individual systematic review.

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II Noise

1. Crystal Noise

assume 1.5 mc/s. bandwidth

P_n – thermal noise generated by crystal

$KT = 4 \times 10^{-21}$ joules (room temperature)

$P_n = KT\Delta f = 4 \times 10^{-21} \times 1.5 \times 10^{6}$

$P_n = 6 \times 10^{-15}$ watts $= 6 \times 10^{-12}$ mw.

(Ref. "Jordan-Whitmer MIT Radiation Lab Series" Page 344-347.)

2. Transistor Noise

$P_n = 2.3\, KT\, F_{1000} \log_{10}\left(\frac{f_2}{f_1}\right)$

F_0 – noise factor at 1000 cycles (numeric)

For SB 100 assume NF = 20 db

$F_0 = 100$

$P_n = 2.3 \times 4 \times 10^{-18} \times 100 \times \log\left(\frac{1.5 \times 10^6}{2 \times 10^3}\right)$

$= 9.2 \times 10^{-16} \times 2.88 = 26.5 \times 10^{-16}$ watt

$P_n = 2.65 \times 10^{-12}$ mw.

(Ref. Shea "Transistor Audio Amplifier" Page 124-128)

3. Total power from both sources:

$P_{Tn} = 8.65 \times 10^{-12}$ mw

or approx. 10^{-11} mw.

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III Video Amplifier Gain Required.

Minimum voltage required for crystal in pulse stretcher is 0.1 volt. This is the voltage required to drop the forward resistance to less than 10,000 ohms.

$$\text{Power} = \frac{(.1)^2}{10000} = 10^{-3} \text{ mw.}$$

For signal to noise ratio of 1 the input power is 10^{-11} mw therefore the power gain required is $10 \log \frac{10^{-11}}{10^{-3}} = 80$ db.

IV Pulse Stretcher Loss

Assume 1000 to 1 pulse stretching ratio. The power level will be decreased by this factor or there will be a 30 db loss in the pulse stretcher.

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V Audio Amplifier Gain Requirement

Assume 1 mw required at the output. This places a requirement of 110 db overall gain & the audio amplifier must have a gain of 60 db.

110 = 80 − 30 + 60
V.A. P.S. A.A.

VI Total number of Stages

Video amplifier — 4
Audio Amp. — 3
7

Audio amp — 18 mw.
Video — 6 mw.
24 mw total power required to supply bias.

5 v battery 2400 w hrs.
or ½ amp hour.

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